National Climatic Data Center

DATA DOCUMENTATION

FOR

DATA SET 6404 (DSI-6404)

ASOS 30-SECOND CEILOMETER DATA

December 11, 2002

National Climatic Data Center
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1. Abstract: A major part of the NWS modernization effort in the 1990's is the implementation of the Automated Surface Observations System (ASOS). The ASOS Cloud Height Indicator (CHI) is a laser ceilometer that features a rapid pulse and sampling rate. The pulse rate varies from 620 Hz to 1,120 Hz according to ambient air temperature. At a nominal pulse rate of 770 Hz, the ceilometer outputs 9,240 pulses during a 12-second sampling period. The vertical resolution is 50 feet up to 12,600 feet above ground level (AGL). The maximum reporting height is 12,000 ft. The ceilometer data are sampled by the ASOS software once every 30 seconds. The accumulated 30-second data are arranged by height and averaged over a time-weighted 30-minute period to determine up to three cloud layers for each observation.

This 30-second Ceilometer data set contains the 30-second samples and sensor status information for twenty-five ASOS reference sites below. Because of data volume and time requirements for downloading the ceilometer data, these high-resolution data are not downloaded or archived for other ASOS sites.

STATION	CALL	STATION	CALL
Astoria, OR	AST	Mobile, AL	MOB
Atlanta, GA	ATL	Paducah, KY	PAH
Atlantic City, NJ	ACY	Pittsburgh, PA	PIT
Brownsville, TX	BRO	Portland, ME	PWM
Bismarck, ND	BIS	Raleigh-Durham, NC	RDU
Charleston, SC	CHS	Salt Lake City, UT	SLC
Dallas-Ft. Worth, TX	DFW	San Francisco, CA	SFO
Denver, CO	DEN	Sault Ste. Marie, MI	CUI
Grand Rapids, MI	GRR	Syracuse, NY	SYR
Great Falls, MT	GTF	Tucson, AZ	TUS
Lincoln, NE	LNK	Tulsa, OK	TUL
Los Angeles, CA	LAX	West Palm Beach, FL	PBI
Minneapolis-St. Paul, MN	MSP		

2. Element Names and Definitions:

Information for some of the elements, particularly the ceilometer status indicators, is incomplete. All information provided by the NWS ASOS Technical Division is reproduced here.

General information: Each element is classified as numeric [N] or alphanumeric [A] as indicated after each element name. Values recorded in numeric elements are right-justified with unused positions zero-filled; signed numbers always begin with a "+" or a "-" in the left-most position. Recorded values in alphanumeric elements are left-justified and unused positions are filled with blanks or a constant value when specified. Missing and unknown values of numeric elements are generally indicated by all nines; sometimes recorded as a signed number. In instances when all nines in a numeric element could represent a value within the range of values for the element, another numeric constant (outside the range of values) will be used to indicate missing/unknown. Missing and unknown values of alphanumeric elements are recorded as all blanks.

WBAN [N]

The WBAN (Weather Bureau, Army, Navy) number is a unique five-digit station identification number assigned by NCDC.

ICAO [A]

The ICAO (International Civil Aviation Organization) call sign is a unique four character station identifier assigned by the ICAO.

FAA [A]

The FAA (Federal Aviation Administration) call sign is a unique three or four character station identifier assigned by the U. S. Federal Aviation Administration.

YEAR [N]

The year (LST) of observation.

MONTH [N]

The month (LST) of observation. The range of values 01 - 12.

DAY [N]

The day (LST) of observation. The range of values 01 - 31.

HR [N]

The hour (LST) of observation. The range of values 00 - 23.

MIN [N]

The minute (LST) of observation. The range of values 00 - 59.

SEC [N]

The second (LST) of observation. The value is 00 or 30.

CEIL ID [N]

The ceilometer ID number. The range of values is 1 - 3. Most stations will have one ceilometer and will be assigned an arbitrary number of 1. At sites with two or three ceilometers, the ID number will correspond to the order of data receipt. The first 30-second record received for a specific time will be assigned a "1", the second a "2" and the third a "3". The ceilometer ID is used to distinguish among up to three records with the same date and time.

ECHO IND [N]

The echo indicator defines the type of signal received by the ceilometer. The range of values is 0 - 4 and 9.

0 - no echo (clear air)
1 - one cloud layer detected
2 - two cloud layers detected
3 - no visible cloud detected, layers of water vapor produce a return signal. The ceilometer data estimates a vertical visibility and thickness.
4 - sky is partially obscured and no cloud base is detected.
9 - missing/unknown

ALARM STATUS [A]

The alarm status indicates if any status flags (field 15) are set. The two character field may be "0b" OR "11", where b is a blank.

0b - all alarm status flags are in OK state
11 - at least one alarm status flag is set

1ST LAYER HEIGHT [A]

The height in feet Above Ground Level (AGL) of the base of the first cloud layer. The height is derived by statistical analysis of data acquired by a vertical-sensing laser beam cloud height indicator during a 12-second period of the previous 30 seconds.

The range of values is 100' to 12,000'and "/////". Missing (inoperable) is recorded as 99999. Height for clear sky is recorded as "/////". Precision is to the nearest 100' for cloud heights between the surface and 5,000' to the nearest 200' for cloud heights between 5,000' and 10,000' and to the nearest 500' for cloud heights above 10,000'.

Note: If the ECHO IND element is recorded as 3, the vertical visibility will be recorded in this field instead of cloud layer height. The vertical visibility is the height at which 50% of the strength of the laser beam is lost due to scattering only.

1ST LAYER THKNESS [A]

The thickness in feet of the first cloud layer is represented by distance into the cloud ("fixed-base" cloud, e.g., cumulus, stratocumulus, or altocumulus: ECHO IND value 1 or 2) where one-half of the pulse beam strength is lost due to attenuation, scattering, and absorption. Thickness for "fixed base" clouds is recorded in 50-foot increments from 50-500 feet inclusive.

The thickness for "non-fixed-base" clouds (ECHO IND value of 3) can be any value of 50-foot increments up to nearly 12,000 feet. It is represented by the distance into the cloud where all of the pulse beam strength is lost.

Missing (inoperable) is recorded as 99999. Thickness for a clear sky is recorded as "/////".

2ND LAYER HEIGHT [A]

The height in feet Above Ground Level (AGL) of the base of the second cloud layer. The height is derived by statistical analysis of data acquired by a vertical-sensing-laser-beam-cloud-height indicator during a 12-second period of the previous 30 seconds.

The range of values is 100' to 12,000' and "/////". Missing (inoperable) is recorded as 99999. When clouds are not present for the second layer or the sky is clear, this height is recorded as "/////". Precision is to the nearest 100' for cloud heights between the surface and 5,000' to the nearest 200' for cloud heights between 5,000' and 10,000' and to the nearest 500' for cloud heights above 10,000'.

Note: If the ECHO IND element is recorded as 3, the vertical visibility will

be recorded in this field instead of cloud layer height. The vertical visibility is the height at which 50% of the strength of the laser beam is lost due to scattering only.

2ND LAYER THKNESS [A]

The thickness in feet of the second cloud layer is represented by distance into the cloud ("fixed-base" cloud, e.g., cumulus, stratocumulus, or altocumulus: ECHO IND value 1 or 2) where one-half of the pulse beam strength is lost due to attenuation, scattering, and absorption. Thickness for "fixed base" clouds is recorded in 50-foot increments from 50-500 feet inclusive.

The thickness for "non-fixed-base" clouds (ECHO IND value of 3) can be any value of 50-foot increments up to nearly 12,000 feet. It is represented by the distance into the cloud where all of the pulse beam strength is lost.

Missing (inoperable) is recorded as 99999. When clouds are not present for the second layer or the sky is clear, this thickness is recorded as "/////".

STATUS FLAGS [N]

Ten one-character indicators that define the status of the ceilometer at the time of the observation. Unless otherwise indicated, a value of 0 means OK or 'yes' and a value of 1 means an alarm condition exists or 'no'. Missing/unknown is recorded as 9.

Position	
1	Hardware alarm
2	Supply Voltage alarm
3	Laser Power Low alarm
4	Temperature alarm
5	Solar Shutter ON
6	Blower ON
7	Heater ON
8	0 = Units in feet 1 = Units in meters
9	0 = Data is height-squared normalized only 1 = Data is height-squares and extinction normalized
10	0 = Window conditioner heater released to be turned on if other conditions warrant 1 = Window conditioner heater is shut off

GAIN [N]

The gain used in the ceilometer system. The value may be 0 or 2. Missing/unknown is recorded as 9.

0 - The gain used is 250
2 - The gain used is 930

PULSE FREQ [N]

The laser pulse frequency. The values range from 0 to 7 (620Hz to 1120Hz). The control circuitry attempts to keep average laser power constant. Consequently, a high frequency indicates a low signal pulse energy. Missing/unknown is recorded as 9.

:

0 - 620Hz
1 - 660Hz
2 - 710Hz
3 - 770Hz
4 - 830Hz
5 - 910Hz
6 - 1000Hz
7 - 1120Hz

RMS NOISE [N]

Noise Root Mean Square (RMS) voltage in units of Analog-digital Conversion (ADC) increments, computed from the 100 highest bins of the latest 12-second measurement period. Values range from +0.00 to +9.99. The decimal point is omitted from the data. Missing/unknown is recorded as -999.

SUM [N]

The sum total of backscattered power per unit solid angle (i.e. range and instrument normalization is applied). The range of values is +000 to +999. Missing/unknown is recorded as -999.

IIN INFO [N]

Information related to the internal processing algorithms. Values range from +000 to +999. Missing/unknown is recorded as -999.

LAS [N]

Measured laser power in units of ADC increments. Values range from 000-200. Missing/unknown is recorded as 999.

INTL TEMP [N]

Internal temperature governing the receiver sensitivity in tenths of degrees Celsius. The values range from -09.9 to +99.9. The decimal point is omitted from the field. Missing/unknown is recorded as -999.

OFFSET [N]

Offset of the zero signal relative to the data table minimum in units of Analog-digital Conversion (ADC) increments. Values range from 00.00 to 99.98. The decimal point is omitted from the field. Missing/unknown is recorded as 9999.

XX INFO [N]

Information related to internal processing algorithms. Values range from +00 to +99. The first digit indicates the number of scans used to determine the cloud information. Missing/unknown is recorded as -99.

EXTCT COEFF [A]

A number representing the calculated extinction coefficient values of the ten lowest range gates (0 - 500 feet). The number determines if an obscuration is ground based or not. Missing/unknown is recorded as -99.

Note: Special characters " " and "# " may also appear in this element*

3. Start Date: The first ASOS ceilometer data received were for October 1992 from Tulsa, OK and for November 1992 from Lincoln, NE. By June 1994, 7 of the 25 reference stations were providing ceilometer data.

4. Stop Date: Ongoing.

5. Coverage: North America

a. Southernmost Latitude	25N
b. Northernmost Latitude	48N
c. Westernmost Longitude	124W
d. Easternmost Longitude	70W

6. How to Order Data:

Ask NCDC's Climate Services about the cost of obtaining this data set.
Phone: 828-271-4800
FAX: 828-271-4876
E-mail: **NCDC.Orders@noaa.gov**

7. Archiving Data Center:

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, NC 28801-5001
Phone: (828) 271-4800.

8. Technical Contact:

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, NC 28801-5001
Phone: (828) 271-4800.

9. Known Uncorrected Problems: No information provided with original documentation.

10. Quality Statement: Responsibility for data quality control (QC) rests with NWS electronics technicians and station managers. QC is performed at 3 levels, the observing site, at Weather Forecast Offices, and at the ASOS Operations and Monitoring Center. Several automated error checks are accomplished at the observation site. When downloaded to NCDC, the data are processed through computer software to reformat the data. No attempt is made to correct the data.

11. Essential Companion Datasets: None. The following data sets are derived from these data:

ASOS 1-minute data processed into DSI-3285.
ASOS 5-minute data processed into DSI-6401.
Daily Summary Data, processed into DSI-3210 and published in the Local Climatological Data (LCD) publication.

Monthly Summary Data
Hourly Observations (SAO) transmitted via AFOS (in the future AWIPS) and processed into DSI-3280, published in the LCD.

12. References:

National Weather Service, March 1998: ASOS USER'S GUIDE, NOAA-NWS, Silver Spring, MD